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(ATI-0016)

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REMARKS

Claims 1-3, 5-10, and 12-20 remain pending in the present Application. Claims 1, 2, 9, and 17 have been amended. Support for the amendment to Claims 1, 9, 17 can be found in paragraph [0021]. Claim 2 has been amended to address the 112 rejection below. No new matter has been added by way of amendment.

Reconsideration and allowance of the claims are respectfully requested in view of the above amendments and the following remarks.

Claim Rejections Under 35 U.S.C. § 112

A. Claim 2 stands rejected under 35 U.S.C. § 112, first paragraph, as lacking enablement.

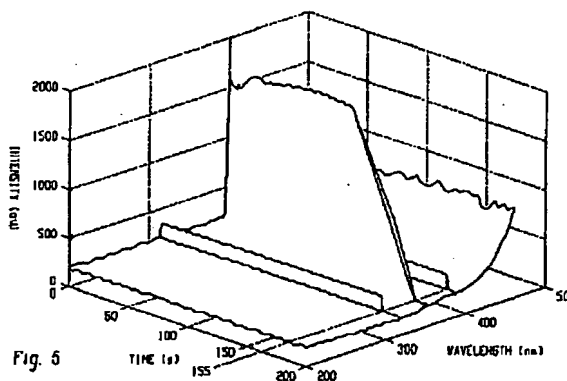
The rejection has been rendered moot by way of amendment.

Claim Rejections Under 35 U.S.C. § 102(b)

A. Claims 1-3, 5-8, and 17-20 stand rejected under 35 U.S.C. § 102(b), as allegedly anticipated by U.S. Patent No. 6,281,135 to Han et al. (hereinafter "Han") as evidenced by any one of US Pat. No. 6,495,825 to Chace, US Pat. Publn. No. 2003/0003243 to Ueno, US Pat. No. 6,021,672 to Lee, US Pat. Publn. No. 2006/0055624 to Mizumura, US Pat. No. 5,151,296 to Tokunaga, and US Pat. No. 5,322,590 to Koshimizu. Applicants respectfully traverse.

Han fails to anticipate the claims because there is no disclosure of a drying process as claimed. The claimed drying process is markedly different from a method of detecting an endpoint during an oxygen free plasma ashing process for removing photoresist. Moreover, the oxygen-free plasma process as disclosed by Han would not result in exposing the low k dielectric layer to photons in an amount or intensity effective to cause excitation, scission and/or fragmentation of contaminants contained within the low k dielectric layer as claimed by Applicants. As discussed in the previous response, Han's Figure 5 graphically illustrates a three dimensional view showing time evolution of light intensity emitted from 200 nm to 500m during an oxygen free plasma process. Applicants have reproduced the graph below.

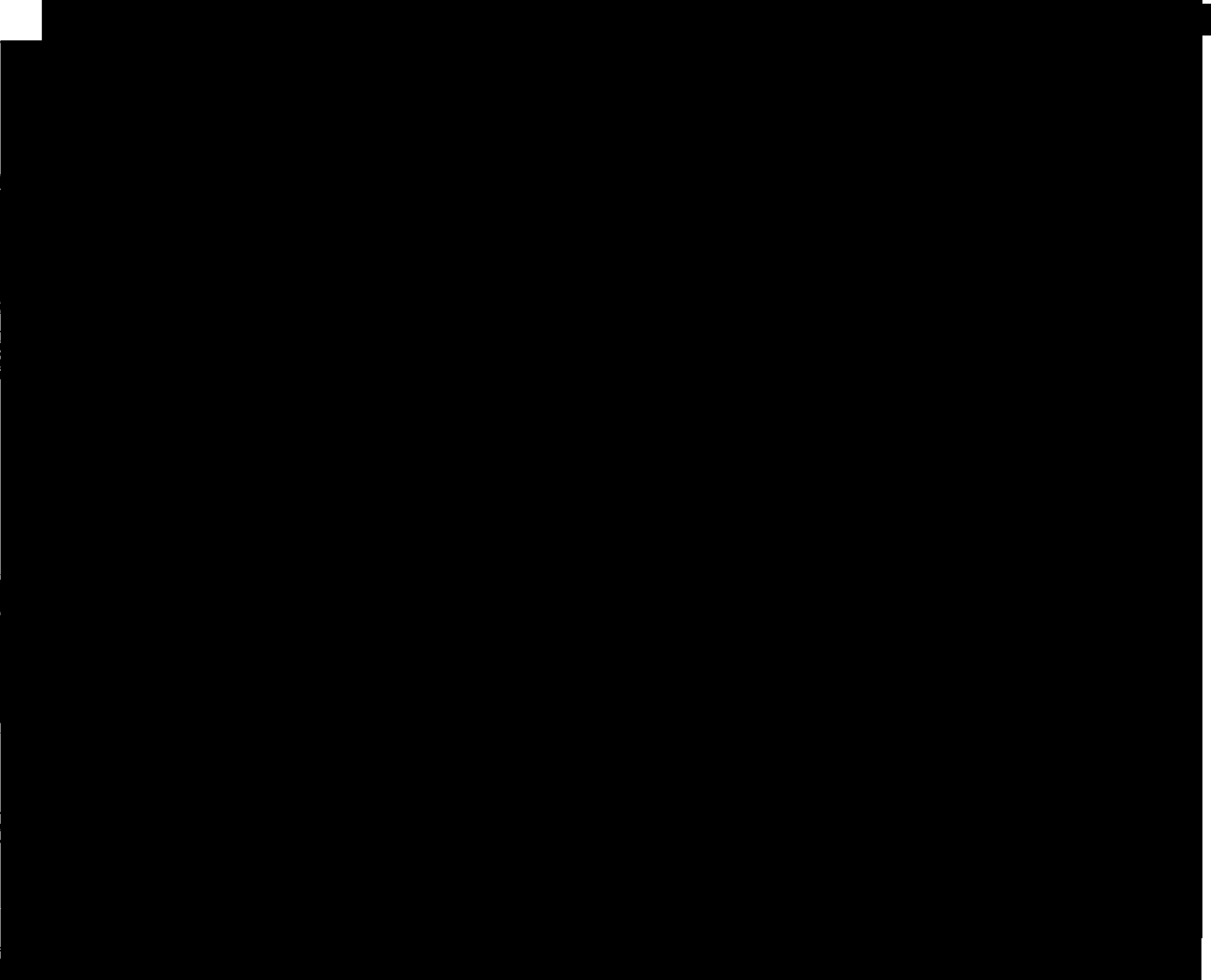
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Once the photoresist is removed, the amount of UV light is substantially non-existent at the wafer level. The peak shown at about 387 or 388nm (line emission, not broadband) is due to an emission signal related to CN/CH, which is directly related to the presence of photoresist on the wafer and that is produced as a byproduct of the reaction during the ashing of photoresist – not due to the oxygen-free plasma alone. At the wafer level, without the emission signal related to reaction byproduct, i.e., in the absence of photoresist in the plasma gas composition for forming the oxygen free plasma, the spectra would be similar to that shown at times greater than 155 seconds. That is, there would be no emission signal of any practical significance at wavelengths in the 200 to 500 nm range at the wafer level resulting from the generation and exposure of the substrate to the oxygen free plasma as taught by Han. This phenomena is what allows Han to predict endpoint of photoresist removal. Whether or not Han discloses other embodiments, e.g., fluorine containing gases and their mixture, is of no consequence since at the wafer level, the amount of UV light would be substantially non-existent so as to afford Han with an enabled process for detecting endpoint of an ashing process for removing photoresist. Even if present, it certainly would not be at an intensity effective to cause excitation, scission, and/or fragmentation of contaminants. Moreover, the amount of radiation is at most on the order of a few microwatts. Dependent Claim 6 features, wherein the photons incident to the substrate have an energy density of about 10 milliwatts per square centimeter to about 1 watt per square centimeter.

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It is also noted that even if broadband radiation were generated by the plasma in the plasma tube (32 in Fig. 3 of Han) between microwave traps 46 and 48, it would not illuminate the wafer 98 surface uniformly, as would be required for the drying process to work as taught (see last sentence of paragraph 31 of Applicants' disclosure and Fig. 1)]. Further, there is no expectation of broadband emission between 150-200nm at the wafer level, downstream from the plasma source, under the conditions taught by Han, nor is such taught. The emission near 500nm, pointed out by the examiner, is not from the plasma – it is actually from the tungsten-halogen lamps used to heat the wafer from underneath (back side), which is being captured due to the large acceptance angle of the



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It is also noted that even if broadband radiation were generated by the plasma in the plasma tube (32 in Fig. 3 of Han) between microwave traps 46 and 48, it would not illuminate the wafer 98 surface uniformly, as would be required for the drying process to work as taught (see last sentence of paragraph 31 of Applicants' disclosure and Fig. 1)]. Further, there is no expectation of broadband emission between 150-200nm at the wafer level, downstream from the plasma source, under the conditions taught by Han, nor is such taught. The emission near 500nm, pointed out by the examiner, is not from the plasma – it is actually from the tungsten-halogen lamps used to heat the wafer from underneath (back side), which is being captured due to the large acceptance angle of the detection device 92 through optical port 90 in Fig. 3 of US 6492, 196. Since these lamps irradiate the backside of the substrate, any contaminant or film on the front side is not exposed to this radiation. If necessary, Applicants can provide a Declaration to this effect.

In contrast, Applicants' process claims feature, *inter alia*, exposing a low k dielectric layer to photons of a broadband spectrum having wavelengths of about 150 nm to about 500 nm and effecting excitation, scission and/or fragmentation of contaminants contained within the low k dielectric layer. Because the amount of UV light is substantially non-existent at the wafer level in the process as taught by Han, there can be no excitation, scission and/or fragmentation of contaminants contained within the low k dielectric layer.

The secondary references fail to provide any evidence that Han would inherently result in exposure of the dielectric to photons as suggested in the Office Action. In Chace, an "apparatus for simulation of UV radiation exposure behavior with real time *analysis of output volatiles*. The invention also provides methods of performing real time analysis of *volatile species generated upon UV irradiation of a material sample*. The apparatus and methods of the invention are especially useful in the analysis and screening of *photoresist materials*" is disclosed (see Chace, Col. 2, emphasis added). There is no evidence provided therein of a drying process that includes contamination removal in the presence of low k dielectrics as claimed by Applicants. First, it is noted that Chace is directed to the analyses and screening of photoresists not low k dielectrics. Moreover, the particular section cited in the Office Action details sensitivity of photoresists, e.g., DUV, I-Line, etc., which are well establish terms of art in the industry. At any rate, Applicants have amended there claims to provide a broadband spectrum. The radiation sources for lithographically

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patterning the photoresist are substantially coherent laser sources having well defined wavelengths, e.g., 365 nm, 248, nm, and the like. There is no disclosure of exposing the wafer to photons at the wafer level as claimed.

In addition, Chace specifically precludes the introduction of contaminants into the chamber, since that would render the invention ineffective: “[p]referably, any tubing used does not introduce excessive contaminants to the chamber, such as would hinder analysis of volatiles from the sample under test.” (see Chace, Col. 3, ll. 47-50). One cannot expect prior art that teaches to keep contaminants out of the process chamber to suggest an invention for removal of contamination from an already contaminated material in the process chamber. Moreover, it is noted that Chace is fairly explicit in its disclosure that “[w]here the (photoresist) material sample is coated onto the substrate, preferably any solvent present in the sample is removed by drying, pre-exposure baking or out-gassing of the sample before radiation exposure” (see Chace, Cols. 4-5). Therefore, not only is the sequence of drying in the prior art prior to radiation exposure, the drying herein is completely different from the drying defined and taught by the applicants.

The remaining secondary references are deficient for the same reasons as Chace. These references fail to provide evidentiary support that the excited gases disclosed by Han produce photons of a broadband spectrum in an amount effective to cause excitation, scission and/or fragmentation of contaminants contained within the low k dielectric layer while leaving the low k material un-degraded, as claimed by Applicants

In view of the foregoing, the rejection is requested to be withdrawn.

It is believed that the foregoing amendments and remarks fully comply with the Final Office Action and that the claims herein should now be allowable to Applicants. Accordingly, reconsideration and allowance are requested.

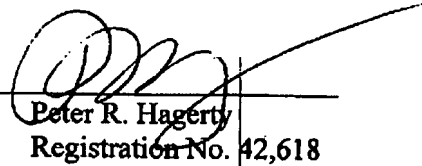
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If there are any additional charges with respect to this Amendment or otherwise, please charge them to Deposit Account No. 06-1130 maintained by Applicants' attorneys.

Respectfully submitted,

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